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Retrospective analysis of treatment indicator of conservative treatment and intervention of surgery of spasticity of upper and inferior limb of an interdisciplinary neuro-orthopedic spasticity consultation

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Retrospective analysis of treatment indicators for conservative treatment and surgical intervention for spasticity of upper and lower limbs in an interdisciplinary neuro-orthopedic spasticity clinic.

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Abstract

BACKGROUND AND OBJECTIVE: This retrospective study analyses the goal assessment of the treatment of spasticity. The indications for and the achievement of the goal of botulinum toxin injections were compared to orthopedic procedures and others.

METHODS: A database was created from the patients' medical files. The efficiency of treatment was then evaluated using the improvement in the sub-goals of the International Classification of Functioning, Disability and Health (ICF): pain (B280-B289), function of the joints and bones (B710-B729), improvement of mobility (D450-DN83) and personal maintenance (D510-D599). The results are discussed after a literature review.

RESULTS: The botulinum toxin injection was more common than orthopedic procedures. Orthopedic procedures showed a tendency to be more efficient regarding the improvement in ICF objectives.

CONCLUSIONS: This study was unable to prove a statistically significant difference between botulinum toxin and orthopedic procedure regarding ICF objectives due to the number of subjects being too small. But it showed that 83.4% of patients were treated by

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botulinum toxin before surgery and only operated in the case of failed goal-achievement. The surgery then enabled the goal to be achieved. This systematic goal assessment is necessary in order to understand better the efficiency of the management of spasticity treatment methods.

Keywords: spasticity, management, botulinum toxin, orthopedic procedure

Introduction

Spasticity refers to an abnormal, velocity-dependent increase in muscle tone resulting from interruption of the neural circuitry regulating the muscle and is a common complication of cerebral palsy, brain injuries, spinal cord injuries, multiple sclerosis and stroke (Satkunam, 2003). Its incidence after a stroke is 17% to 38% (Leathley et al., 2004; Lundström, Terént, & Borg, 2008). Moreover, the severity of spasticity increases over time (Opheim, Danielsson, Alt Murphy, Persson, & Sunnerhagen, 2014) and induces significant pain, contractures, joint subluxations or dislocations, peripheral neuropathy and pressure ulcers (Gorgey, Chiodo, & Gater, 2010).

The prevention of complications due to spasticity is therefore important to improve the quality of life of patients.

Among the different treatments of spasticity, botulinum toxin A is a well-tolerated and effective focal intervention for the reduction of spasticity, and it is widely recommended in clinical practice (Turner-Stokes, Fheodoroff, Jacinto, Maisonobe, & Zakine, 2013). Botulinum toxin is only reimbursed by Swiss health insurance for spasticity due to a stroke and the maximal recommended dose per session in Switzerland is 400 IU. In some cases, repeated administration of botulinum toxin leads to the development of resistance due to circulating antibodies (Brin, 1997). In many patients, it is not possible to treat upper and lower limbs at the same time with a sufficient effect. In this case, it is possible to propose an orthopedic surgical approach to the patient.

Orthopedic procedures can be classified into three major categories: tenotomy, tendon transfer and tendon lengthening (Jozefczyk, 2002). Tenotomies are reserved for the release of the tendon to severely spastic muscles (Jozefczyk, 2002). Tendon lengthening is performed to

weaken spastic muscles and position joints at a more natural and useful angle (Jozefczyk, 2002). Tendon transfers are undertaken so that muscles, which remain at least partially functional, can produce useful movements (Jozefczyk, 2002). Tendon lengthening and tendon transfer are most successful in the lower extremity and tend to improve borderline ambulation (Bleck, 1975).

The management of spasticity needs a multidisciplinary approach to define treatment goals according to the International Classification of Functioning, Disability and Health (ICF). The assessment of the patient occurs over multiple visits to determine the correct combination of therapies and procedures to achieve the best function (de Roode, James, & Van Heest, 2010)

To fulfil this requirement a spasticity outpatient clinic has been developed in the Clinique Romande de Réadaptation and in the department of Neurology at the Lausanne University Hospital (CHUV). Both centers use the same scales and scores to evaluate patients. A first consultation evaluates the indication for a botulinum toxin treatment. When conventional treatments such as physiotherapy, occupational therapy, antispastic drugs or orthosis are insufficient to obtain a satisfactory improvement there is a neuro-orthopedic consultation. A surgical approach is discussed in the presence of an orthopedic surgeon and a specialist in reconstructive and plastic surgery.

Patients and Methods

Patients

Inclusion criteria were to be older than 18, to suffer from spasticity and to have been evaluated in the interdisciplinary neuro-orthopedic spasticity clinic in Lausanne between December 2003 and November 2013. The only exclusion criterion was to have insufficient information in the medical records to complete the database.

Method

As the number of patients was too small to be statistically significant it was decided to carry out an observational study of a group of patients and the treatment they received for individual goal assessment. The goal assessments were taken from the main component of the International Classification of Functioning, Disability and Health (ICF). The database was created using data from patients' medical files of the CHUV in Lausanne, the Neurological Centre Plein Soleil in Lausanne and the Reeducation Centre in Sion.

The primary outcome was to compare the efficiency of treatments in terms of ICF goals. For the chapter Body Function and Structure the chosen sub-goals for this study were improvement in function of the joints and bones (B710-B729) and decrease of pain (B280-B289). The mobility of joints was measured and compared before and after treatment. If the improvement was judged sufficient for the patient, the efficiency of treatment was considered as good efficiency. Because patients were followed for many years, it happened that a treatment with a good efficiency when the patient was first treated did not work well after a certain period. So to distinguish these from treatments which maintained good efficiency, they were noted as partially efficient. The objective concerning pain was evaluated by the patient as good if the pain was relieved, partial if the treatment had no effect and bad if the treatment made the pain worse. The second ICF goal assessment corresponds to two sub-goals from activity and participation: mobility and self-care. Mobility is affected by spasticity in the lower limb(s) and self-care mostly concerns hand spasticity. So it was interesting to compare both. The improvement of mobility is important for patients with lower limb spasticity because it limits mobility and reduces quality of life (Martin, Abogunrin, Kurth, & Dinet, 2014). Just as lower limb spasticity affects quality of life, upper limb spasticity can

have a significant effect on self-care, like Toileting (D530) or Washing oneself (D510) (World Health Organisation, s. d.). Efficiency in terms of self-care and mobility were measured in the same way as the pain sub-goal: good for an improvement, partial if no improvement and bad if the situation got worse.

The secondary outcome was to compare the previous results with results from other articles.

Results

In total, 102 patients attended the interdisciplinary clinic from 2003 but 61 did not have sufficient information in their medical records. 47.6% of patients suffered from spasticity post-stroke. Of 41 patients retained for the study, 78% had botulinum toxin treatment and 44% had surgical treatment (Figure 1). However, only a few patients had surgical treatment without first receiving botulinum toxin (7.3%). Regarding the indication for treatment, we were able to group patients according to four ICF goals: lowering pain (B280-B289), increasing function of the joints and bones (B710-B729), increasing walking performance (D450-N83) and improving personal maintenance (D510-D599) (Figure 3).

The efficiency of decreasing pain was good except for 14% who had partial efficiency. The efficiency of increasing function of the joints and bones was 45% good efficiency, 45% partially efficient and 10% bad efficiency (Figure 4). Botulinum toxin injections accounted for 84% of the treatments improving function.

In the improvement of walking, 31% of the patients had only botulinum toxin injection, 13% only surgery and 54% had toxin botulinum injections followed by surgery. For surgery the major indication for treatment was spastic equinovarus foot: the efficiency was good for 73% of the patients and partial for 27%. Botox had a good efficiency in 31%, partial efficiency in 57%, and bad efficiency in 10% (Figure 4). Regarding an improvement in personal maintenance, 44% of patients had surgical

treatment. The surgery efficiency was good in 50% and partial in 50%. For the botox, there was 20% of good improvement, 60% partial and 20% bad (Figure 4).

Discussion

The botulinum toxin injection treatment was the procedure patients in this study had the most. It can be explained by the fact that botulinum toxin is a safe and reversible procedure. Indeed, effects will last a few months and if the treatment is not satisfying, another procedure can still be tried. In our study, the high number of patients treated with botulinum toxin can also be explained by the type of study. Indeed, as a retrospective observational study, no randomization had been done and the all our patients first went to a spasticity clinic to evaluate the indication of a botulinum toxin injection. In the literature, many articles can be found to prove the efficiency and safety of botulinum toxin. For example, a retrospective analysis from Baricich A et al. (Baricich et al., 2015) evaluated the efficacy and safety of high doses of botulinum toxin in 26 patients affected by upper and/or lower limb post-stroke spasticity. No adverse events were reported and high doses of botulinum toxin were shown to be effective and safe.

The results of the study show that a minority of patients had surgical treatment but with a better improvement in ICF objectives (Figure 2). It can be explained by a selection bias, because as surgery does not allow an easy way back, the surgeon will recommend surgery only for patients who he is sure will benefit from it. But we also found a study from Van Heest AE et al. (Van Heest, Bagley, Molitor, & James, 2015) which compared botulinum toxin injection treatment, surgical treatment and ongoing treatment for children with upper-extremity cerebral palsy. They demonstrated that surgical treatment provides a greater improvement, of modest magnitude, than botulinum toxin injections or regular, ongoing therapy at twelve months. This study could also have a selection bias but it was only for children

who met standard indications for tendon transfer surgery which is also a selection bias.

Regarding the patients' activity, an improvement in walking was demonstrated by a lot of patients with varus equinus spastic foot deformity who had surgical treatment. A retrospective study from Vogt JC et al. (Vogt, Bach, Cantini, & Perrin, 2011) confirms that surgery for equinovarus foot can increase the walking distance. Of 82 patients who were examined up to 65 months after surgery, 74 reported an increase in their walking distance even if moderate. But we also found a study which confirms the efficiency of botulinum toxin injection for equinus foot (Cardoso et al., 2006). So a good multidisciplinary evaluation should be carried out to find the better management depending on the situation.

To compare improvement in mobility which is affected by lower limb spasticity and improvement in personal maintenance which is affected by upper limb spasticity, treatments provided better improvement in walking than in personal maintenance. Maybe the management of lower limb spasticity is better than upper limb spasticity, but with such a small number of patients, the difference is probably not significant. This would be an interesting subject to study in a future research project.

Conclusion

This retrospective observational study shows that a minority of patients had surgical treatment but with better improvement in ICF objectives. But as it is a safer procedure, with 60% of partial success we recommend always trying the botox treatment before surgery. Further studies with goal assessment are needed with a larger population and prospective goal assessment based on ICF evaluation should be completed considering the individual needs of the patient, taking account of the heterogeneous context.

Declaration of interest

There were no financial or personal relationships with other people or organizations that could inappropriately influence this article.

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Figures:

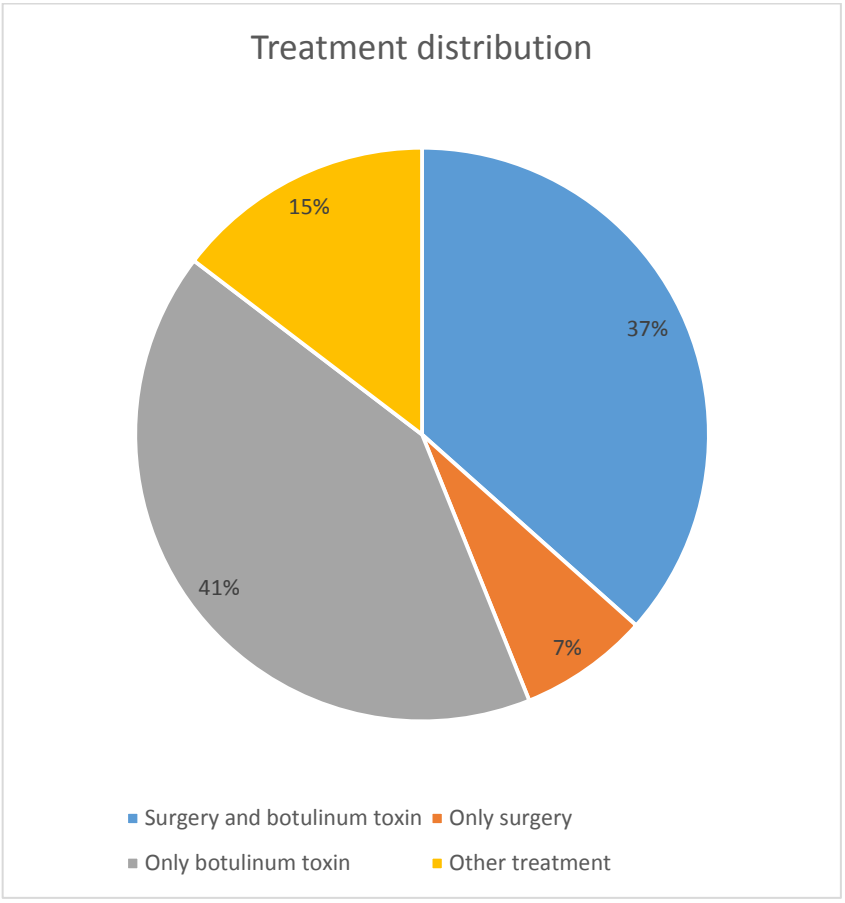

Figure 1

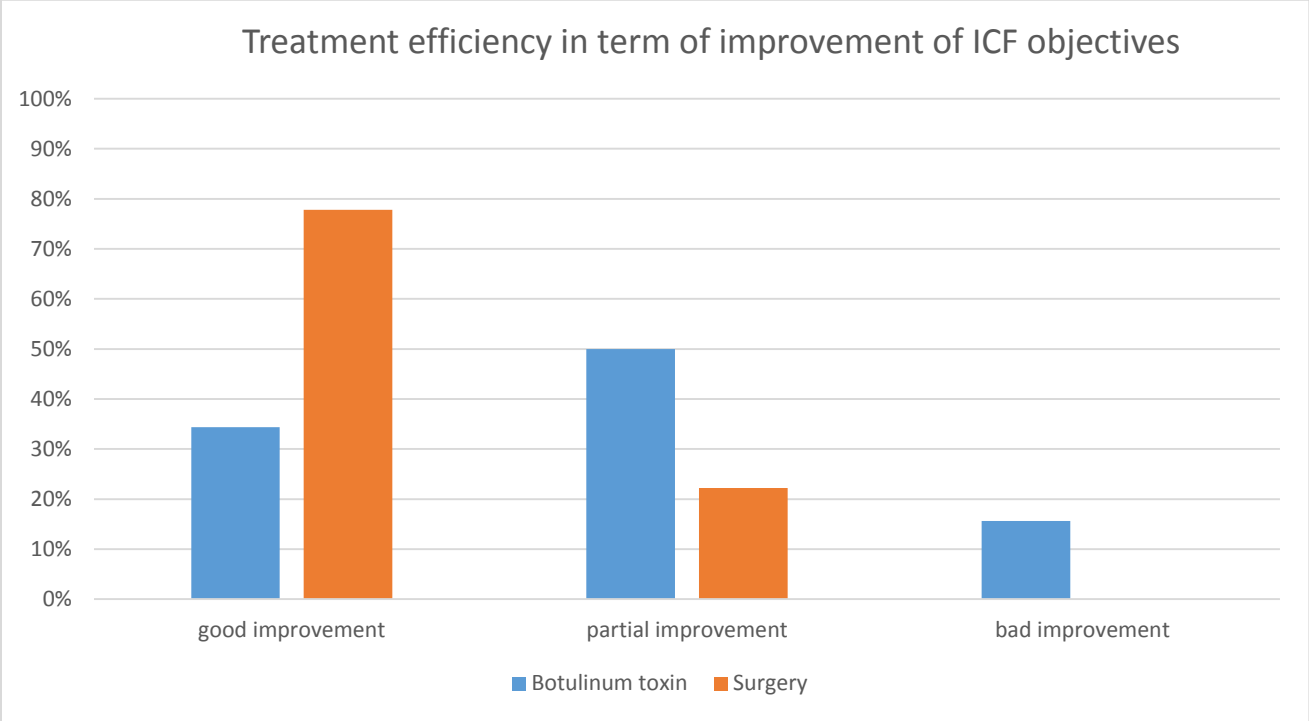
Treatment efficiency in term of improvement of ICF objectives
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
good improvement
partial improvement
bad improvement
Botulinum toxin
Surgery

Figure 2

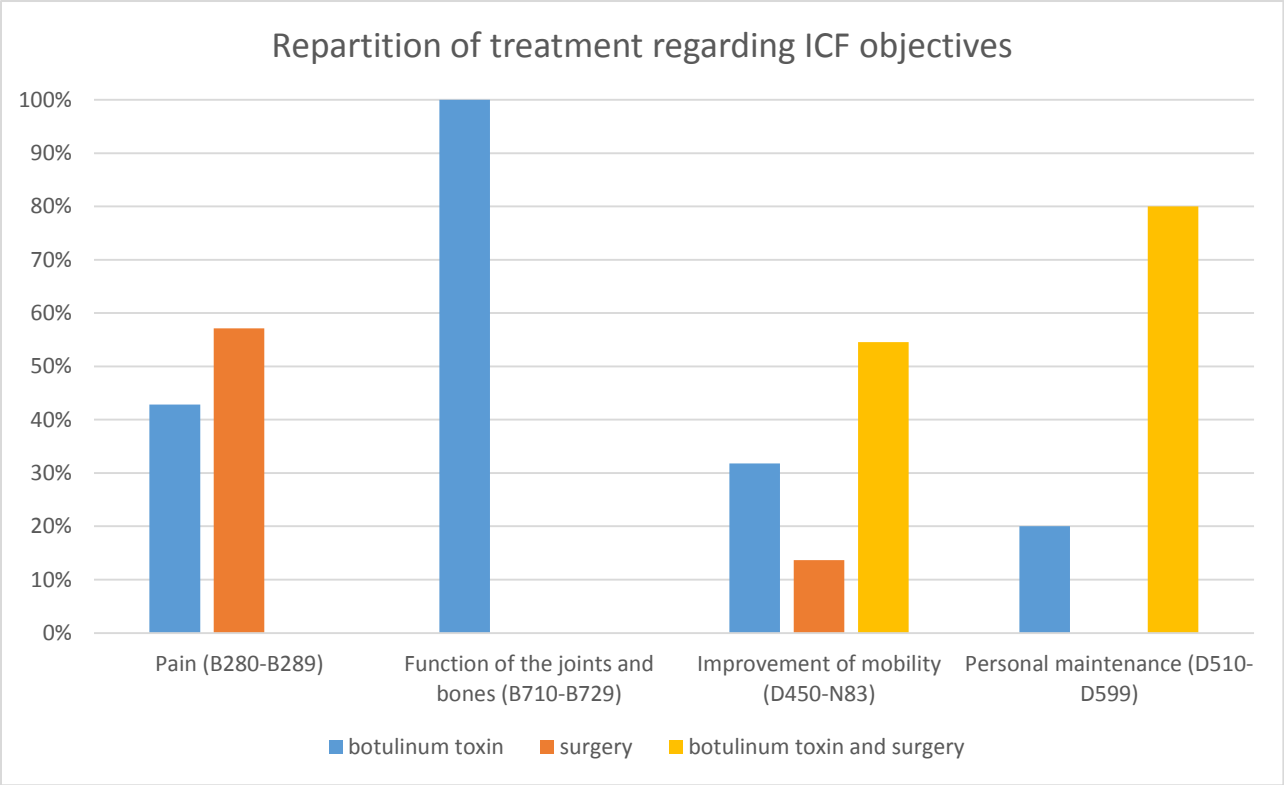
Repartition of treatment regarding ICF objectives
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Pain (B280-B289)
Function of the joints and bones (B710-B729)
Improvement of mobility (D450-N83)
Personal maintenance (D510-D599)
botulinum toxin
surgery
botulinum toxin and surgery

Figure 3

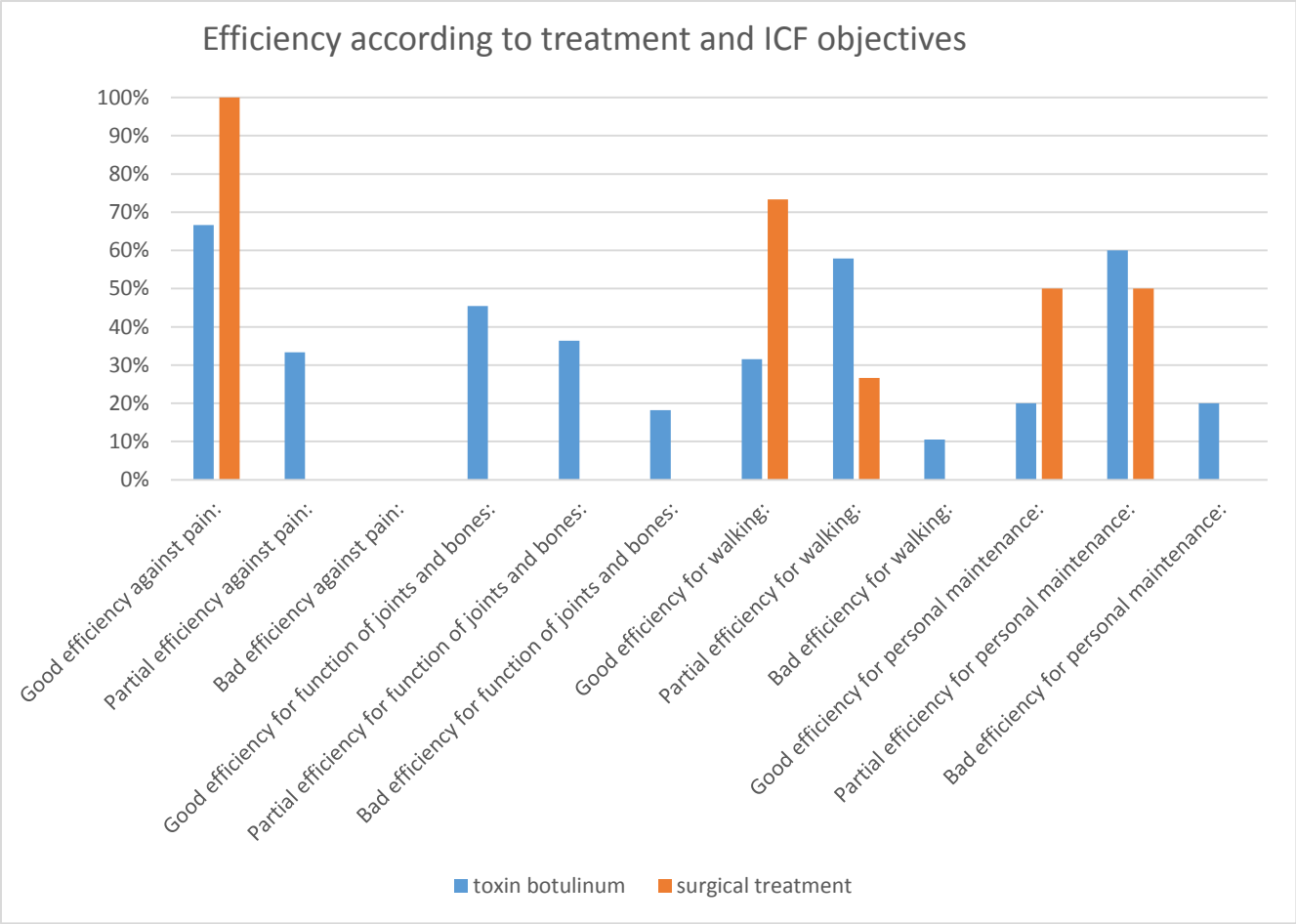
Efficiency according to treatment and ICF objectives
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Good efficiency against pain:
Partial efficiency against pain:
Bad efficiency against pain:
Good efficiency for function of joints and bones:
Partial efficiency for function of joints and bones:
Bad efficiency for function of joints and bones:
Good efficiency for walking:
Partial efficiency for walking:
Bad efficiency for walking:
Good efficiency for personal maintenance:
Partial efficiency for personal maintenance:
Bad efficiency for personal maintenance:
toxin botulinum
surgical treatment

Figure 4